

Calorimetry

- A calorimeter is a device used to measure changes in thermal energy
- Change in water temperature in the device allows us to calculate change in thermal energy

Example:

A 0.500kg sample of water in a calorimeter is at 15 ° C. A 0.04kg block of zinc at 115 ° C is placed in the water. The specific heat of zinc is 388 J/kg ° C. What is the final temperature of the system?

$$E_{hw} = -E_{hzn}$$

$$mc\Delta T = -mc\Delta T$$

$$(1000)(0.5\text{kg})(418\text{J})(T_f - 15^\circ\text{C})$$

$$\begin{aligned}
 &= - (0.04 \text{ kg}) \left(\frac{388 \text{ J}}{\text{kg}^\circ\text{C}} \right) (T_f - 115) \\
 2090 (T_f - 15) &= -15.52 (T_f - 115) \\
 2090 T_f - 31350 &= -1552 T_f + 1785 \\
 \boxed{T_f = 15.7^\circ\text{C}}
 \end{aligned}$$

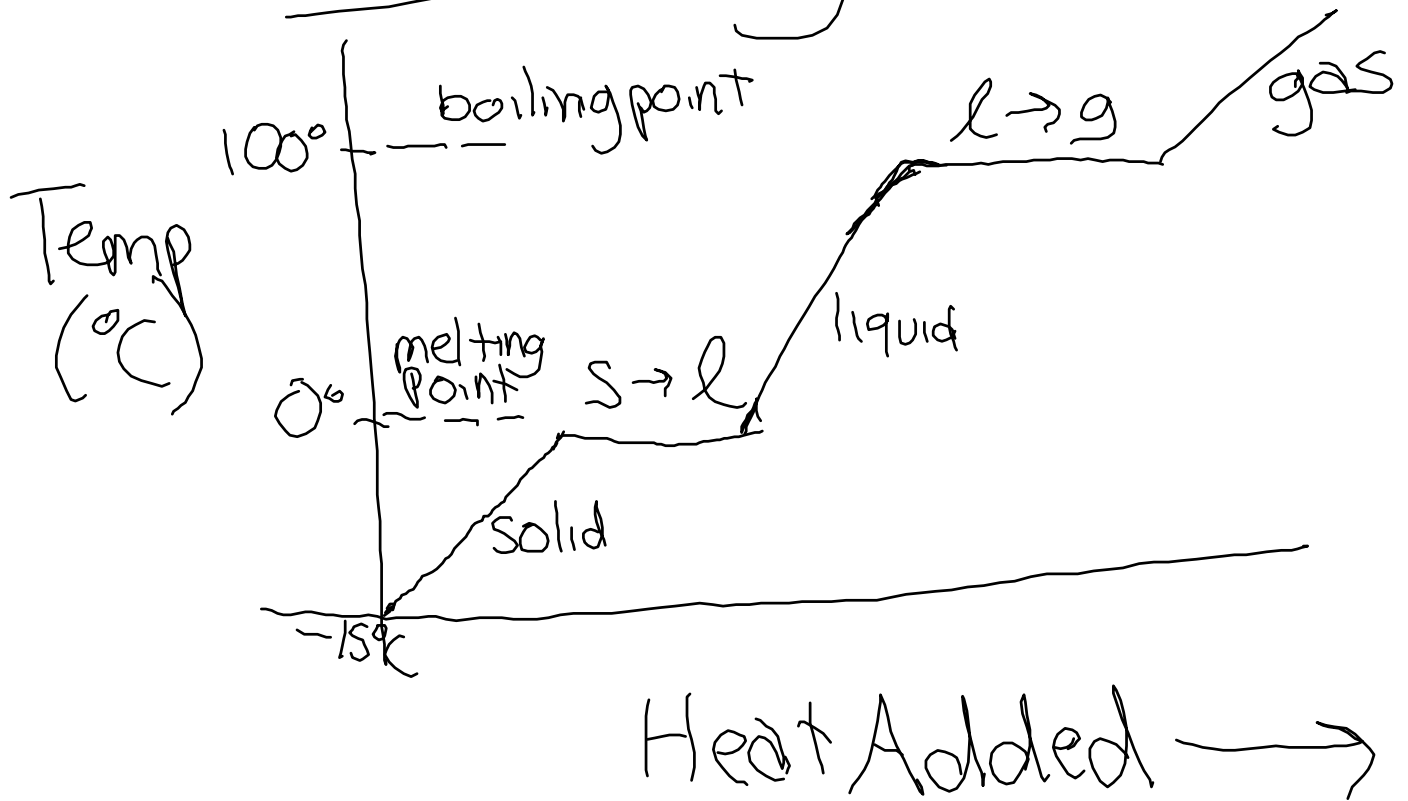
Example 2: A 100g block of Aluminum at 100°C is placed in 100g of water at 10°C . The equilibrium of the mixture is 25°C . What is the specific heat of Aluminum as determined by the experiment?

$$\begin{aligned}
 E_{hw} &= -E_{hAl} \\
 mc\Delta T &= -mc\Delta T \\
 (100\text{g}) \left(\frac{4.18 \text{ J}}{\text{g}^\circ\text{C}} \right) (25 - 10^\circ\text{C}) \\
 &= - (100\text{g}) C_{Al} (25 - 100)
 \end{aligned}$$

$$= - (100g) c_{Al} (\dots)$$

$$C_{Al} = 0.836 \frac{J}{g^{\circ}C}$$

Heating Curves



Heating curves

- Temperature does not change during a phase transition

Melting point

- Temperature at which a substance changes from solid to liquid
- At sufficiently high temperatures, forces between particles cannot hold them in place - they slide past each other
- Adding energy BREAKS BONDS, does not increase temperature

Boiling point

- Temperature at which a substance changes from liquid to gas
- Particles at surface gain enough energy to overcome attractive forces from their neighbours - escape into surrounding space